Introduction

• The health benefits of dairy foods, a major source of calcium, are well documented in the scientific literature with benefits across the lifecycle including control of blood pressure, reduction in cardiovascular mortality and reduced risk of osteoporosis.

• Despite the importance of an adequate calcium intake evidence demonstrates that many individuals have difficulty achieving dietary dairy/calcium recommendations.

• Although it is important to be able to identify those at risk of inadequate dairy/calcium intake, traditional methods of dietary assessment can be burdensome and costly therefore a short, easy-to-administer dairy/calcium assessment tool would be ideal.

• A key criterion that supports the use of a tool in practice and research is its relative validity, determined by how closely the results match those of a reference test.

• A second criterion of importance is a tool’s level of reliability, such that it produces consistent results under similar conditions, either over different time points or when conducted by different researchers.

Method

• A systematic review of the literature was conducted in the electronic databases Medline, Scopus, Ovid, Informit and Web of Knowledge, and in Google Scholar, to identify existing tools that measure dairy and/or calcium intake in adults.

• Search keywords used were calcium, dairy, milk, diet, nutrition and food, combined with tool, questionnaire, food frequency questionnaire, survey, measurement, assessment, evaluation and analysis.

• Included articles were those which developed or tested the validity or reliability of a new tool to measure dairy and/or calcium intake, or of an existing tool, and tools were those intended for use in Western adult populations.

• Tools described in the articles were classified as dairy assessment tools, assessing quantity or frequency of intake of dairy foods, or calcium assessment tools assessing quantity of calcium intake. Some tools fell into both categories.

• Ideal methods for assessment of validity are sensitivity and specificity, Bland-Altman analysis and Kappa measure of agreement.

• When assessing reliability and validity a sample size of ≥100 subjects was considered acceptable.

• A mean difference of 100mg calcium, representing around 10% of RDI or 1/3 of one serve of dairy, was considered clinically significant.

Results

• 30 identified articles reported on 36 tools (4 dairy and calcium; 32 calcium) for the assessment of dairy and/or calcium intake in adults.

• All tools used a food frequency questionnaire and included a range of foods from dairy products and other foods that make important contributions to calcium intake.

• Tools were either self-administered or required a health professional to interview and complete.

• Validity testing was conducted on all dairy and calcium tools and 28/32 calcium tools, using lower order statistical tests such as correlation analysis. All articles failed to differentiate between statistically and clinically meaningful differences.

• One dairy and calcium1 and five calcium tools2-6 showed acceptable levels of validity (Table 1).

• Reliability testing was conducted on two dairy and calcium and four calcium tools with at least moderate agreement demonstrated for only one dairy and calcium1 and two calcium tools.4,5

• Only one tool was considered both reliable and valid for the assessment of dairy intake1 and only two tools for the assessment of calcium intake1, 6.

Discussion

• Based on the review methods used and results of the reliability and validity testing, one tool for assessment of dairy and calcium intake and five tools for assessment of calcium intake are cautiously recommended.

• Common limitations of other tools were the lack of testing for reliability and the lack of tests that provide a measure of agreement.

• The clinical significance of differences identified between tools and reference methods was not discussed by any of the studies included in this review. In order for a tool to be useful, practitioners should be confident that it can identify a clinically meaningful quantity of dairy and/or calcium.

• All eligible studies in this review were of low level (III-2) evidence, as defined by NHMRC, with potential for recall bias, positive respondent bias and recruitment bias thus adding further limitations to the evidence reported herein.

• While several tools are considered appropriate there are inherent limitations to all the reported studies which may limit the use of the tools. These results indicate a need for tools to assess calcium and/or dairy intake in adults to be rigorously tested for reliability and validity.

Acknowledgements

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References


Table 1: Recommendations for validated dairy and/or calcium tools for implementation in the practice and research setting in adults.

<table>
<thead>
<tr>
<th>Author</th>
<th>Tool</th>
<th>Validity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Welten et al1</td>
<td>Dairy Questionnaire</td>
<td>Ca: Mean bias: 73mg;</td>
</tr>
<tr>
<td>Montomoli et al1</td>
<td>Calcium FFQ</td>
<td>Mean bias: 89%; Sp: 87%</td>
</tr>
<tr>
<td>Hacker-Thompson et al1</td>
<td>Online Calcium Questionnaire</td>
<td>Mean bias: 67mg (online);</td>
</tr>
<tr>
<td>Clove et al1</td>
<td>35 or 15-item Calcium FFQ</td>
<td>Mean bias: 86%; Sp: 87%</td>
</tr>
<tr>
<td>Sebring et al1</td>
<td>Short Calcium Questionnaire (87 or 25-item)</td>
<td>Mean bias: 67mg;</td>
</tr>
<tr>
<td>Severo et al1</td>
<td>3-item Calcium FFQ</td>
<td>Mean bias: 89%; Sp: 87%</td>
</tr>
</tbody>
</table>

*also tested for reliability
1Tested for reliability in the study by Miller et al 2010
2Abbreviations: Ba=Bland Altman; LOA=limits of agreement; k=Kappa; FFQ=food frequency questionnaire; Sn=sensitivity; Sp=specificity; Ca=calcium.